

## **PROBLEM SET #5**

**2 % of grade; 13 points possible; max you can earn=10 points**

**DUE: via gradescope, 10:00.00 a.m. on Friday April 26**

*Problem sets must be uploaded and submitted by 10 am. No problem sets accepted after gradescope window closes. Your submitted work must be your own: Problem sets that are identical (in whole or in part) to another student's problem set will receive a zero.*

*Follow these guidelines. Write your GSI's name and your name on the first answer sheet. You can hand write or type your answers or some combination of typing & hand-written; just be sure answers are neat and legible. No answer sheet is provided; use your own paper if you are writing by hand. When you are done, you will scan your problem set answers (see gradescope hints on course website) and convert to a pdf file. No need to scan this sheet of questions. You are responsible for submitting the right pdf file. We will grade what you submit, not circle back to you to tell you that you gave us the wrong file. You must tell gradescope on which page we will find your answers. If you don't tell gradescope which page your answer is on, we won't grade what you submit. Gradescope is accessible via our bcourses site.*

### **1. (1 point)**

The Phillips Curve equation can be described by the equation  $\pi = \pi^e - \beta(u - u^*) + ss$

- A. (½ point) Suppose the expected inflation rate is 2 percent,  $\beta = 0.5$ , the natural rate of unemployment is 5 percent, and there are no supply shocks. When the unemployment rate is 5 percent, what is the inflation rate? When the unemployment rate is 4 percent, what is the inflation rate?
- B. (½ point) Explain why the inflation rate increases when the unemployment rate decreases.

### **2. (1 point)**

The Taylor rule can be described by the equation  $r = r_0 + r_\pi(\pi - \pi^t)$ . Suppose the Fed's "normal" baseline value of the real interest rate is 2 percent,  $r_\pi = 0.8$ , and the Fed's target inflation rate is 3 percent.

- a. (½ point) If the actual inflation rate is 3 percent, what real interest rate will the Fed set? If instead the actual inflation rate is 5 percent, what real interest rate will the Fed set?
- b. (½ point) Explain why the Fed would increase the real interest rate if the inflation rate rose.

### **3. (2 points)**

- a. (1/2 point) What is the connection between the long-run flexible price model and long-term interest rates? (Re-asking this from MT2 because so many people got it wrong on the midterm and it's important.)
- b. (1/2 point) What is the federal funds rate? What is the interest rate on excess reserves? Are these nominal or real interest rates?
- c. (1/2 point) What is the "zero lower bound"? Why does the concept apply only to nominal interest rates? What is the minimum possible value for the interest rate?
- d. (1/2 point) Suppose the central bank had reached the ZLB. How could they then continue to lower the real interest rate?

**4. (2 points)**

A. (1 point) Starting from these 3 relationships, derive the equation for the monetary policy reaction function:  $u = u_0 + \phi(\pi - \pi^t)$ . Be sure to show the full expression for  $\phi$ .

- Taylor rule:  $r = r_0 + r_\pi(\pi - \pi^t)$
- IS equation:  $Y = \frac{A_0}{1-MPE} - \left(\frac{I_r + X_\varepsilon \varepsilon_r}{1-MPE}\right)r$
- Okun's Law:  $u = u^* - 0.4\left(\frac{Y - Y^*}{Y^*}\right) = u^* + 0.4\left(\frac{Y^* - Y}{Y^*}\right)$

B. (1 point) Using words, not the equations, explain how and why the slope of the MPRF changes when there is a decrease in the marginal propensity to consume,  $C_y$ . In your explanation, be sure it's clear what "the slope of the MPRF" means in terms of the relationship between unemployment and inflation in the economy.

**5. (1 point; from Fall 2010 final, #4)**

Suppose that the MPRF and PC are both non-linear. Prices are much more flexible when unemployment is low than when unemployment is high. When price flexibility is very high, the Fed is very hawkish. When prices are particularly sticky, the Fed is more dovish. Draw these MPRF and PC together on one set of axes. Briefly explain why you drew your graph as you did.

**6. (1 point; from Spring 2017 final, #1)**

Briefly define each of the three models of expectations: static, adaptive, and rational.

**7. (4 points; from Spring 2017 final #4)**

Suppose a recession has hit and the economy can be described by the following:

$$\begin{aligned} \text{Fed's target inflation rate} &= 3\% \\ \text{initial expected inflation rate} &= 2\% \\ r_\pi &= 0.8 \\ r_0 &= 2\% \\ MPE &= 0.6 \\ A_0 &= 3,800 \\ I_r &= 30,000 \\ X_\varepsilon \varepsilon_r &= 20,000 \\ u^* &= 5\% \\ Y^* &= \$10,000 \text{ billion per year} \\ \text{supply shocks} &= 0 \\ \beta &= 0.5 \end{aligned}$$

A. (2 points) Suppose expectations are static. What are the short-run sticky-price equilibrium values of the inflation rate, the unemployment rate, the Fed's target real interest rate, and real GDP? Show your work.

B. (2 points) Suppose instead that expectations are adaptive:  $\pi_{t+1}^e = \pi_t$ . In the next period, what are the new equilibrium values of the inflation rate and the unemployment rate? What real interest rate does the Fed now set? What is the new equilibrium value of real output? Show all your work.

**8. (1 point)**

Suppose inflationary expectations are static (never change). Draw an initial MPRF and Phillips Curve, with initial equilibrium at  $u = u^* = u_0$  and  $\pi = \pi^e = \pi^t$ . Now, show the effect of the government increasing its spending.